Übung 5

Lösungen bitte via Moodle / learnweb, bis zum 22.06.2010 einreichen.

Aufgabe 1 Inference (10 Points)

a) [5 pts.] What does inference mean?
b) [5 pts.] What is the difference between "forward" inference and "backward" inference?

Aufgabe 2 Some basic concept of exact inference (10 Points)

a) [3 pts.] What is the amount of edges in a tree, if the amount of vertexes is n?
b) [3 pts.] Consider we are given a topological ordering of vertexes of a DAG. We need a level map of the same DAG. What is the easiest way to get a level map?
c) [4 pts.] Is the level map unique in general? (Is there any graph, which has several level maps?)

Aufgabe 3 Inference: variable elimination (10 Points + 10 Bonus)

Suppose, we are given the following facts:
If a person got cold (C), she/he drinks tee (T) with a certainty of 0.8.
If a person did not got cold (C), she/he drinks tee (T) with a certainty of 0.3.
If a person got cold (C), she/he drinks orange juice (J) with a certainty of 0.75.
If a person did not got cold (C), she/he orange juice (J) with a certainty of 0.25.
If a person got cold (C), she/he has fever (F) with a certainty of 0.5.
If a person did not got cold (C), she/he has fever (F) with a certainty of 0.1.
If a person has fever (F), she/he contacts the doctor (D) with a certainty of 0.8.
If a person does not has fever (F), she/he contacts the doctor (D) with a certainty of 0.2.
If a person drinks both tee and orange juice, she/he spends "lot of" money (M) in MyShop with certainty of 0.5.
If a person only drinks tee, she/he spends "lot of" money in MyShop (M) with certainty of 0.3.
If a person only drinks orange juice, she/he spends "lot of" money in MyShop (M) with cert. of 0.4.
If a person drinks neither tee nor orange juice, she/he spends "lot of" money in MyShop (M) with certainty of 0.2.

a) [5 pts.] Figure these implications in a directed graph!
b) [5 pts.] Construct (several) conditional probability tables between the given variables based on these facts!
c) [Bonus 10 pts.] Suppose Peter has spent a "lot of" money in MyShop! What is the probability, that he will contact the doctor? Please answer this question by reconstructing the marginal probability table of D using the variable elimination algorithm.

Aufgabe 4 Construction of cluster trees   (10 Points)

a) [3 pts.] What is a cluster tree?
b) [3 pts.] Construct a clique cluster tree for the Markov network in Figure 1, please. (If necessary, you may add some new edges to the graph.)
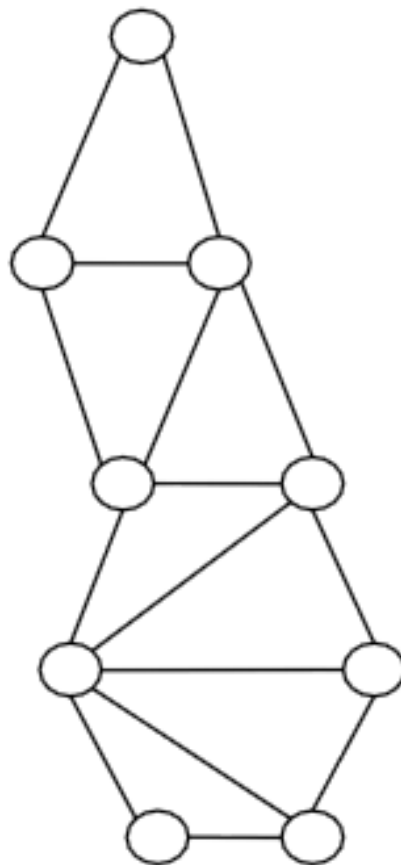c) [4 pts.] In which case is it necessary, to add new edges to the graph, before constructing the cluster tree?

Figure 1.